October 2011
Fall/Winter Issue

Online version available at:
http://www.wrh.noaa.gov/byz/jargon/fall11.pdf

Points of Interest

- Fall/Winter Normals
- Record Flooding
- Billings Radar Upgrade
- Winter Weather Safety

Inside this issue:

Jetstream Jargon

National Weather Service—Billings, Montana
weather.gov/billings

2011 Year In Review

Submitted by Keith Meier
Meteorologist In Charge

2011 will be remembered for the incredible impact of natural disasters not only in the United States, but also internationally. One of the largest disasters of the year was the earthquake and resulting tsunami that devastated Japan. So far this year, natural disasters in the United States have claimed over 700 lives and resulted in over $35 billion in losses, including the tornadoes that devastated Joplin, Missouri, those that swept across portions of Alabama, Georgia and Tennessee, as well as the massive flooding that occurred on the Mississippi and Missouri Rivers. Recently, tragedy struck the Indiana State Fair associated with thunderstorm winds, and Hurricane Irene greatly impacted the Northeastern United States.

Closer to home, the record rains of May across much of the area contributed to historic flooding which impacted nearly every county across our Warning and Forecast Area. Although the severe thunderstorm and tornado season were short-lived, we did have a couple of tornado events which narrowly missed impacting cities in the area.

So what can we take away from this year of disasters? As we all know, we cannot change the weather, but we can take steps to mitigate the impacts of extreme weather events. The National Weather Service nationally is making a concerted effort to emphasize community resiliency against the impacts of extreme weather events. This initiative is referred to as developing a WeatherReady Nation.

I'm proud to say that over the years, our office has been proactively reaching out to decision makers and planners throughout local, state and federal government, in addition to public event organizers, those responsible for the well-being and safety of vulnerable populations at hospitals and nursing homes, and those responsible for the integrity of community infrastructure (i.e. electricity, water, etc.). Much of this effort has been to ensure decision makers and planners are aware of potential or imminent weather events which may require them to invoke various contingency plans. Additionally, we assist these entities in developing strategies for being WeatherReady utilizing all the information and expertise we have available. This advance awareness and planning results in mitigating the impacts of hazardous weather on our communities and ideally will prevent tragedies or loss of life.

We recently completed a review of the flooding events of this past spring and summer to evaluate the effectiveness of our services. We were told that our services were vital in providing decision makers and planners across the area with key information which assisted them in staging resources and responding proactively as impacts from flooding occurred. Additionally, we were able to avert potential loss of life on a recent wildfire by alerting responders to an approaching severe thunderstorm, in addition to working with public safety officials on several large public events in the area.

So why is this important to discuss here? As part of our "weather team", we all share the common purpose of ensuring the safety of our communities from weather and other natural hazards. Your role as a weather spotter, Cooperative Weather Observer, CoCoRaHS observer, local, state or federal government official, or other key partner, ensures the success of our WeatherReady initiative. Without the email reports, phone calls and Facebook posts of weather information, without the daily collection of routine weather/climate information, and without inclusion in various meetings, building community preparedness and resiliency for the impacts of hazardous weather would not be possible.

For your service, thank you!

The JetStream Jargon is published semi-annually by the National Weather Service in Billings, Montana.

Questions or comments, please email: carolyn.willis@noaa.gov or call 406-652-0851.

Coop Corner

Articles on this Page Submitted by Carolyn Willis

Observing Program Leader

2011 has been a busy year so far, and it's hard to believe winter is almost here. I will soon be winterizing Fischer Porter recording precipitation gages, and will try to stop by and visit those of you I haven't seen yet this year. If you need a snow measuring stick, please let me know, and I'll drop one by on my visit, or mail one to you. It is time once again to think about removing the tubes from inside your rain gages, since water will freeze and break the bottoms of the inner tubes. Although metal tubes are sturdier than plastic, freezing can still pop the weld in the bottom of the tube, causing it to be inaccurate. The middle of October is the usual time to remove the inner tube from your gage.

Thank you to all of our Cooperative and CoCoRaHS observers. Your data is very valuable, and we appreciate you!

Back yards will soon be looking like the photo to the left, as winter edges closer. Photo by Carolyn Willis

Alex Collie - Receives National Weather Service's Most Prestigious Cooperative Observer Award!

Alex Collie, Cooperative Weather Observer in MacKenzie, in Fallon County, has been awarded the National Weather Service's most prestigious award. Out of over 11,000 observers nationwide, Alex was one of only six observers selected for the 2011 Jefferson Award. This award is presented to observers who have gone above and beyond normal circumstances in taking observations and sending them to the National Weather Service. Alex has been taking observations for over 60 years, in addition to caring for his late wife who had polio, and running a ranch. Even when Alex was in the hospital himself with an illness, he couldn't wait to get back to taking observations. Congratulations Alex!

Nationwide Push for Electronically Entered Observations

There is a push nationwide to receive observations from our Cooperative Observing Network in "real time," or as soon as possible after the observation is taken. Many of you already enter your observations into WxCoder, (the computer-based program,) or IV-ROCS, (the touch-tone phone based program.) Some of you call us each day with your observation, or we call you, and we enter your observation into our computer system. If you are not currently transmitting your daily weather observation by one of these four methods, and only mailing the paper B-91 form at the end of the month, please give me (Carolyn) a call so we can get you set up with the method that works the best for you. In this day and age of "real time" data, it's important that we receive your data as close as possible to your scheduled observation time. Even if you only report precipitation, and don't have any that day, your "zero" is still important data for us.

Relocating Lodge Grass Fischer Porter Gage

Submitted by Carolyn Willis, Observing Program Leader

On September 8, Vickie Stephenson, Hydrometeorological Technician, and David Smith, Electronics Technician, relocated the Fischer Porter Recording Precipitation Gage from the Farmers Union Oil company to a ranch approximately 5 miles north of Lodge Grass. Welcome to the Cooperative Observing Network, Dianna and Lyle Neal.

Left: Hydrometeorological Technician Vickie Stephenson stands by the Fischer Porter recording precipitation gage which was installed 5 miles north of Lodge Grass. Right: photo of completed installation. Photos by David Smith.

January 20, 1954 –

A cold morning.

-40 Colstrip

-39 Roundup

-37 Hardin

-36 Columbus and Miles City

-27 Broadus

Hello/Goodbye

Submitted by Vickie Stephenson
Hydrometeorological Technician

Chauncy Schultz, joined Team Billings in September as a General Forecaster. Chauncy is originally from New Salem, North Dakota, and comes to us from the National Weather Service Forecast Office in North Platte, Nebraska.

David Church joined our office in September as a Meteorologist Intern. He is a graduate of North Carolina State University.

Matt Solum, General Forecaster at the NWS Billings, transferred to our Western Regional Office in Salt Lake City in August after 6 ½ years in Billings.

Ryan Leach, Meteorologist Intern, transferred to Missoula, as a General Forecaster after 2 years with Team Billings.

Significant Spring and Summer Flooding of 2011

Submitted by Tom Humphrey
Lead Meteorologist

I was working an evening shift in late May at the National Weather Service Office in Billings when the phone rang. On the other end of the line was an elderly gentleman with a report of significant flooding. His report echoed many during a month in which it seemed the rain would never stop. I will never forget his comment near the end of our conversation. He said, "…I have lived in this area for nearly 75 years, and I have never seen flooding like this up here." This individual was just one of many who had similar stories to tell during, and after, a flood season for the record books.

Credit: Larry Mayer, "Farms and homes are flooded by the Musselshell River at Harlowton, Montana in this aerial view on Thursday, May 26, 2011," *Billings Gazette*, May 26, 2011

The mountains were buried under record snowpack as April turned into May and that was a cause of great concern. Thoughts were turning to the spring of 1997 when many rivers hit record levels due to massive snow melt. In truth though, the snow melt season almost turned out to be an afterthought as the flooding started very early with relentless rainfall. May was extremely wet with many areas picking up 4 to 6 times the amount of precipitation that is normally received during the month. (See figure Page 8) In fact, May of 2011 was the wettest on record in Billings with 9.54 inches of rainfall. That was 7.06 inches above normal and broke the old record by 1.83 inches. Billings set daily rainfall records three times during the month and the 3.12 inches received on May 24th set an all-time daily rainfall record.

The first big flood event of May occurred from the 8th through the 16th. A strong area of low pressure moved from Wyoming into the Dakotas and dropped 2 to 5 inches of rainfall across a large part of the area. The heaviest rain, around 5 inches, fell over southeast Montana. The rainfall combined with some lower elevation snow melt to produce flash flooding near Livingston, causing roads to be closed and washed out west of Livingston. The hardest hit area during this event was Custer County, where numerous roads were washed out. The Tongue River near Miles City flooded on May 10-11th from this event, and several water rescues had to be accomplished as the Kinsey Road Levee system was washed out.

The biggest event happened during the last two weeks of May when three slow moving storm systems moved across Wyoming. These systems tapped into moisture from the Gulf of Mexico and dropped a total of 6 to 10 inches of rainfall across the area on the 18th through the 24th. Another 2 to 4 inches of rain fell from the 29th through the 31st during another slow moving storm system. The heavy rainfall from these weather systems combined with an already saturated ground and swollen rivers from earlier May rains, to produce record flooding in many locations. Many small streams and creeks flooded quickly and often, and caused several roads and bridges to be washed out along the east slopes of the Beartooth/Absarokas and throughout the Shields River Valley. Flooding was tremendous off the higher terrain as the water flowed into tributaries leading into the Yellowstone River and resulted in extensive damage to road systems in Sweet Grass, Stillwater and Carbon counties. Flood waters rose rapidly on the Musselshell River in late May and caused record flooding in Roundup where the water reached rooftop levels. Several roads from Harlowton to Roundup were closed due to high water, and many evacuations occurred due to the record flooding. Many water rescues were also performed in the Crow Agency region of Big Horn County as the Big Horn and Little Bighorn Rivers shut off communities due to high water. Emergency shelters were established in Billings to aid displaced residents. Interstate 90 south of Hardin to the Wyoming state line was closed for several days as water ran over top of the roadway. Parts of Highway 212 were also closed for a period of time due to flooding. Governor Brian Schweitzer declared a state of emergency due to the flood waters and deployed the National Guard to Roundup and Crow Agency to help with rescues.

Another big precipitation event occurred during the first week of June when 2 to 4 inches of rain fell in the Musselshell River Basin. This prompted more evacuations in Roundup and continued the record flooding through the basin. Food supplies had to be delivered by boat to communities isolated from transportation routes in Golden Valley and Musselshell counties.

The snow melt aspect of the flood season was delayed due to the cool and wet weather in May and early June. The snow melt season actually began a month to a month and a half later than normal and impacted the area from late June to the second week of July. Many main stem rivers reached a secondary peak in early July due to snow melt. This was the latest peak on record for many locations. The cooler weather actually helped the situation somewhat as the snow in the higher elevations melted slowly in early to mid-June, taking a bit of the bite off the snow melt season. That being said, river levels still rose dramatically once again and reached flood levels quite easily, but the impacts were not nearly as dramatic as the impacts from early May to mid-June. All rivers finally fell below flood stages by mid-July and brought the historic flood season to a close.

This certainly was the most dramatic flood season the area has seen in quite some time.

(continued on page 5)

(continued from page 4)

A hearty "thank you" goes out to all our spotters for the reports and pictures that were sent our way. Your information was invaluable and helped us a great deal in our communication process. Despite the terrible flooding, our partners and local responders performed in a truly remarkable manner. The resolve of the people impacted most by the floods typified the Montana way of life. Despite the ongoing challenges ahead, as the cleaning up process continues, there is a sense of relief from many people. This relief stems from the realization that despite how devastating this flood season was, it could have been much worse. If the heavy rains had combined with peak snow melt, water levels would have been much higher and the damage much greater. That is hard to imagine.

Credit: Larry Mayer, "Flood waters cut through Pryor Creek Road near Huntley in this aerial view on Sunday," *Billings Gazette*, May 22, 2011

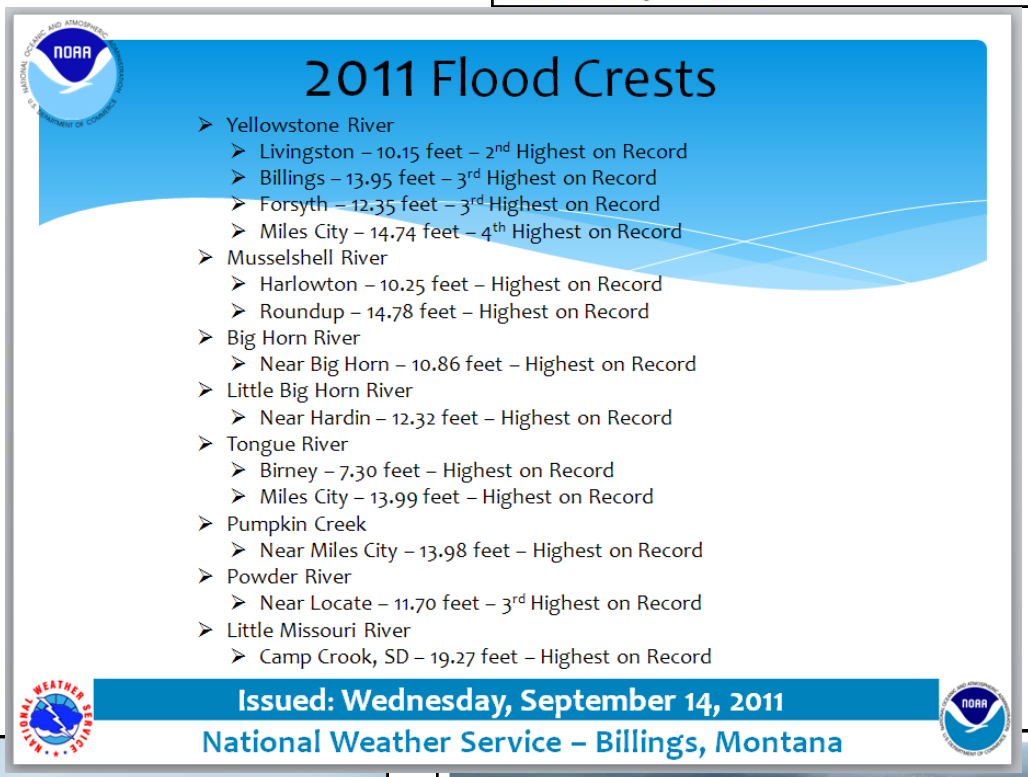
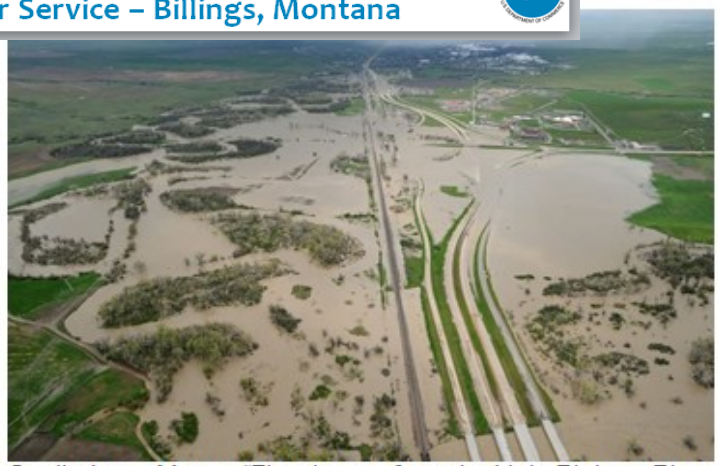


Photo by Tom Frieders
Record snowpack in the Beartooth Mountains in the winter of 2010-2011 contributed to flooding issues.



Credit: Larry Mayer, "Flood water from the Little Bighorn River covers I-90 near Crow Agency in this aerial view on Sunday," *Billings Gazette*, May 23, 2011

Photo Courtesy of NWS Glasgow

December 25, 2009 - Heavy snow fell across southeast Montana, along with wind chills of 10 to 25 below zero; amounts included: Ekalaka 14-20", Baker 6-15", Ridgway 14", Capitol/Ismay/Story 12", Broadus 8".

Winter Safety Checklists

Submitted by Carolyn Willis, Observing Program Leader
http://www.wrh.noaa.gov/byz/winter/wednesday.php?wfo=byz

The primary concerns during a winter storm are loss of heat, power and telephone service and a shortage of supplies if storm conditions continue for more than a day. Have these items available:

At Home and Work

- Flashlight and extra batteries
- Battery powered NOAA Weather Radio
- Extra food and water
- Extra medicine and baby items
- First-aid supplies
- Emergency heat source
- Heating fuel
- Fire extinguisher
- Smoke alarm—Test once a month
- Make sure pets and livestock have plenty of food, water and shelter

In Vehicles

- Mobile phone and charger
- Blankets/sleeping bags
- Flashlight with extra batteries
- First-aid kit
- Extra clothing
- Shovel
- Windshield scraper and brush
- Tool kit
- Tow rope
- Battery booster cables
- Water container
- Compass and road maps
- High-calorie, non-perishable food
- Small can and waterproof matches to melt snow for drinking water
- Knife

On the Farm/Pets

- Move animals to sheltered areas
- Haul extra feed to nearby feeding areas
- Have water available; most animals die from dehydration in winter storms
- Make sure pets have plenty of food, water and shelter

Answers to Winter Weather Terminology Quiz on Page 10

1. D
2. C
3. A
4. B
5. F
6. H
7. E
8. G

If You Are Caught In a Winter Storm

Submitted by Carolyn Willis, Observing Program Leader
http://www.wrh.noaa.gov/byz/winter/thursday.php?wfo=byz

Outside

Find Shelter: Try to stay dry. Cover all exposed body parts.

If no shelter: Build a lean-to, windbreak or snow cave for protection from the wind. Build a fire for heat and to attract attention. Place rocks around the fire to absorb and reflect heat.

Stay Hydrated: Melt snow for drinking water. Avoid eating snow. Eating snow will lower your body temperature.

In A Vehicle

Stay In Vehicle: You will become quickly disoriented in wind-driven snow and cold. Run the motor about 10 minutes each hour for heat. Open the window a little for fresh air to avoid carbon monoxide poisoning. Make sure the exhaust pipe is not blocked.

Be Visible to Rescuers: Turn on the dome light at night when running the engine. Tie a colored cloth, preferably red, to your antenna or door. After snow stops falling, raise the hood to indicate you need help.

Exercise: From time to time, move arms, legs, fingers and toes vigorously to keep blood circulating and to keep warm.

January 1, 1997 - An ice jam on the Stillwater River 2 miles southwest of Columbus flooded a ranch; the flood stranded 2 people who had to be rescued by emergency personnel.

Inside

Stay Inside: When using alternate heat from a fireplace, wood stove, space heater, etc., use fire safeguards and properly ventilate.

No Heat: Close off unneeded rooms. Cover windows at night. Eat and drink plenty. Food provides the body with energy for producing its own heat. Keep the body replenished with fluids to prevent dehydration. Wear layers of loose-fitting, lightweight, warm clothing. Remove layers to avoid overheating, perspiration and subsequent chill.

A herd of mule deer enjoy a fall day near Moorhead, MT. Photo by Carolyn Willis

Thank You Observers and Spotters

Submitted by Tom Frieders
Warning Coordination Meteorologist

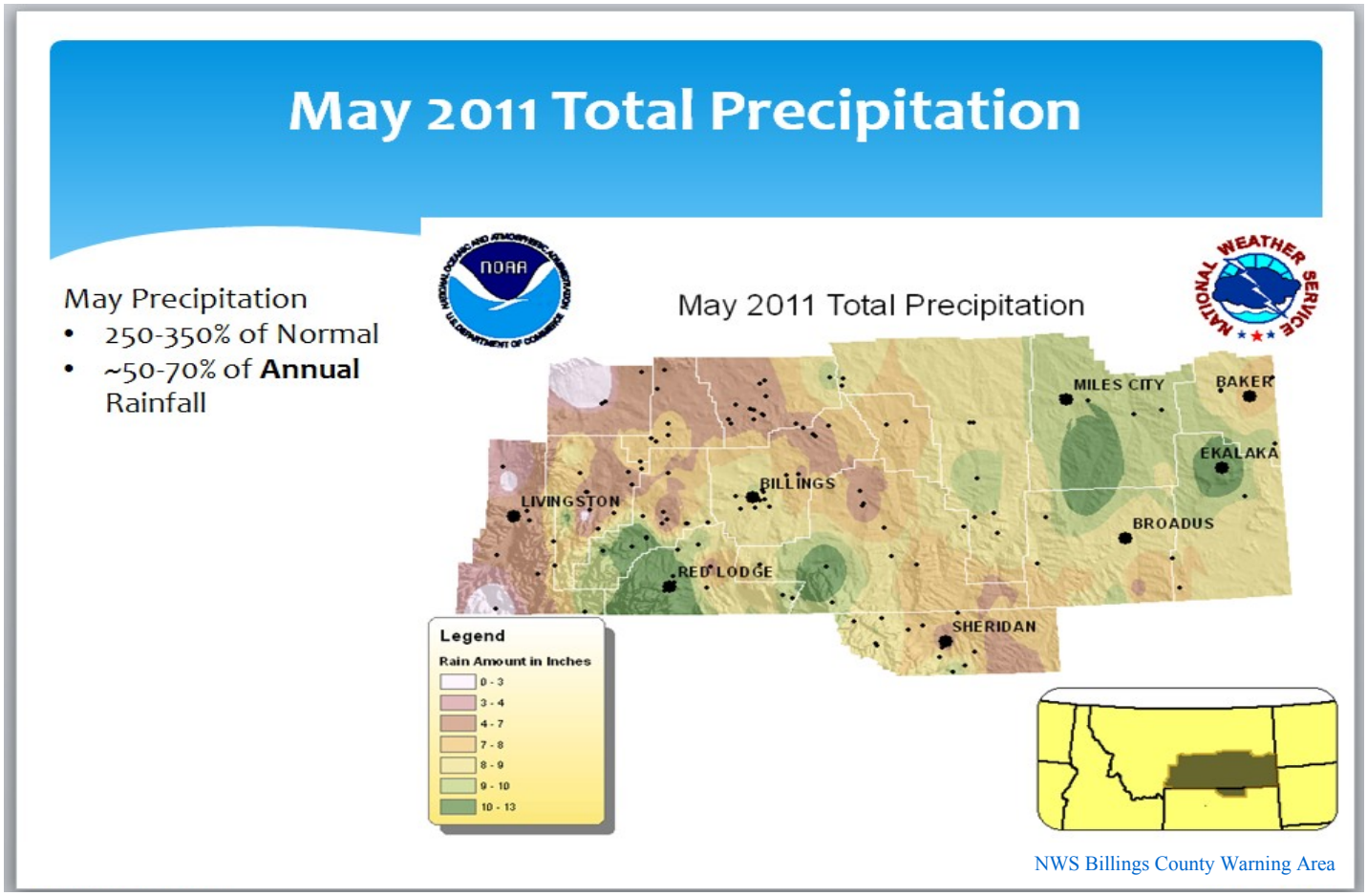
As we head into the winter season, we look back at another spring and summer of severe weather. From record flooding resulting from melting snow and heavy rainfall, to our typical thunderstorms producing damaging hail, high winds and even a few tornadoes, it was another active season.

We want to again thank our volunteer observers and spotters for all of your reports. Your commitment is very much appreciated! These reports play a major role in our warning decision process and are crucial in supplementing our Doppler radar. Pictures, distributed via Facebook and e-mail, gave us additional detail on the impacts of these storms.

The following communications are available for submitting your reports:

- Phone: Call the spotter number or 406-652-0851
- E-mail: billings.nws@noaa.gov
- Facebook: http://www.facebook.com/US.NationalWeatherService.Billings.gov
- CoCoRaHS: http://www.cocorahs.org/
- E-spotter: http://espotter.weather.gov/
- Twitter (#wxreport)

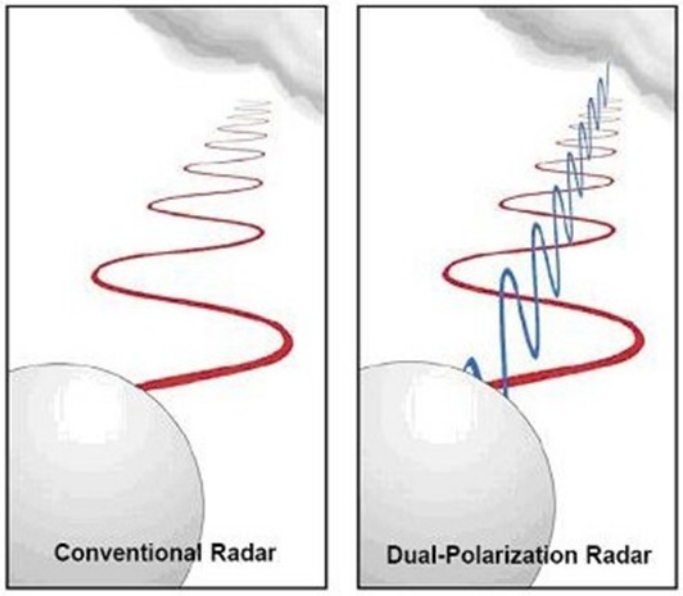
If you have any questions regarding these programs, feel free to contact our Warning Coordination Meteorologist, Tom Frieders (tom.frieders@noaa.gov) . We look forward to your snow reports this winter!



3-D Radar Upgrade Coming to National Weather Service Billings

Submitted by Todd Chambers
Lead Meteorologist

From October 24th through November 6th the National Weather Service Doppler radar in Billings will undergo a major upgrade. A team of engineers from the Radar Operations Center in Normal Oklahoma will install a Dual Polarization (Dual-Pol) capability to the Radar. This upgrade will allow forecasters to see individual precipitation particles in 3-dimensions. The Doppler radar currently transmits and receives a signal in the horizontal plane giving a 2-dimensional view of precipitation particles. The Dual-Pol upgrade will allow the radar to transmit and receive signals in both the horizontal and vertical planes. This Dual-Pol capability will allow forecasters to determine the shape of particles in the atmosphere, be they precipitation or non-precipitation in origin.



Graphic above shows the difference in conventional radar waves and Dual-Polorization radar waves.

So why is this upgrade important? Well, precipitation particles have different shapes depending on whether they are liquid or ice, or a combination of both. Non-precipitation particles have very random shapes. With Dual-Pol capability, forecasters utilizing new software can use these shape differences to better determine what type of precipitation is falling. Some radar returns appear to be precipitation but are really just a bunch of insects or birds (yes the Doppler can actually detect insects), and this upgrade will detect this difference. In strong thunderstorms there are many types of precipitation contained within the storm. With the current radar it can be difficult at times to distinguish between very heavy rain, rain mixed with hail and large hail cores. Using the Dual-Pol upgrade, warning forecasters will have a greater ability to determine the location of the large hail and improve warnings.

One of the neat features of the Dual-Pol upgrade will be the ability to identify where snow turns to rain. Snowflakes have a distinctive shape compared to raindrops. This characteristic will be helpful in discerning between snow, reezing rain, or drizzle during the winter months, in addition to determining the elevation of heavy snow. The ability to differentiate snowfall from rainfall will also allow the radar to better estimate precipitation, which will improve hydrology operations. This Dual Polarization upgrade will result in a better understanding of what is happening within the storms impacting you, leading to better warnings and forecasts.

A National Weather Service Doppler Radar

For the two weeks that the Billings radar will be down, while undergoing this upgrade, ground observations will become very important. Although surrounding radars will still cover the area, this data will be high up in the atmosphere and may not be indicative of what is occurring at ground level. As a result we would ask that spotters be extra vigilant and call in reports of any weather that seems threatening or unusual. Your efforts during this time will help ensure the safety of you and your neighbors while the radar is being upgraded. The Dual Polarization upgrade will result in a better understanding of what is happening within storms impacting the region, leading to better warnings and forecasts to protect lives and property across Southern Montana and Northern Wyoming.

Winter Weather Terminology Quiz

Submitted by Carolyn Willis
Observing Program Leader

Match the definition in the left column with the correct term in the right column

1. ____ A measure of how cold the atmosphere feels, taking not just actual temperature into account, but also wind, which can make the air considerably colder.

2. ____ The potential exists for hazardous winter weather to occur within the next 12 to 48 hours.

3. _____ A type of winter storm characterized by significant amounts of freezing rain.

4. _____ Outlines potential winter storm conditions that might impact the region in the next 7 days.

5. _____ A variety of winter conditions may be possible including heavy snow, blizzard conditions, significant accumulations of freezing rain or sleet and dangerous wind chills.

6. _____ Outlines winter weather conditions that are expected to cause significant inconveniences and may be hazardous. If you are cautious, these situations should not be life threatening.

7. _____ Outlines hazardous winter weather that is either occurring or will be shortly. Immediate action should be taken to protect yourself as well as your pets and livestock. Only travel outside of your home if you absolutely have to.

8. _____ Winds of 35 mph or more with snow and blowing snow reducing visibility to less than 1/4 mile for at least 3 hours.

A. Ice Storm

B. Hazardous Weather Outlook

C. Watch

D. Wind Chill

E. Warning

F. Winter Storm

G. Blizzard

H. Winter Weather Advisory

Answers on Page 6

October 31, 1999 - Strong winds from a dry cold front moved through the area, causing 80 mph gusts in downtown Billings. Gusts of 60-70 mph were common across much of southeast Montana and several wildfires spread because of winds and low humidities.

Below zero temperatures create a frosty landscape in Billings
Photo by Carolyn Willis

The "Voice of NOAA's National Weather Service" Now Broadcasting in Carter County

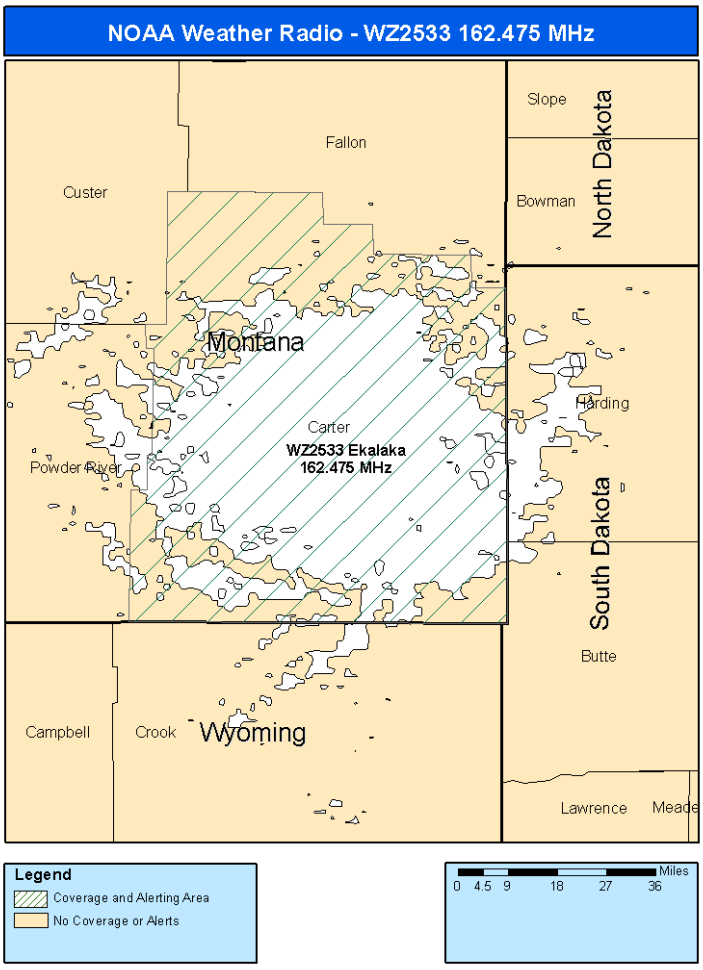
Submitted by Tom Frieders
Warning Coordination Meteorologist

All Hazard NOAA Weather Radio remains a direct link to the National Weather Service's forecasts and warnings every second of every day. Transmitters all across the country alert you of pending severe weather. Not only will they alert you of hazardous weather, but they will also be used by local emergency officials for other non-weather alerts, such as requesting shelter-in-place for hazardous material releases and evacuations for fire emergencies.

Through a partnership with Fallon County 911 and Mid Rivers Communications, we have recently installed a new transmitter south of Ekalaka, MT. This transmitter now broadcasts for much of Carter County in southeast Montana. This has been a great addition to our network in an area that had no coverage prior to this installation.

Weather Radio broadcasts are not available on normal AM/FM frequencies. Rather, they can be received on specially built radios available at many home and electronics stores.

For more details regarding the NOAA Weather Radio Program, please visit http://www.weather.gov/nwr/



The coverage area above is approximate, as signal may be stronger or weaker in some locations and may not be received in all areas.

Above: Bare trees near Powderville, Montana
Below: View of the valley and the Powder River, from Moorhead Road
Photos by Carolyn Willis

Cold Weather Word Search

Submitted by Julie Arthur
Meteorologist

S I B G L O V E S S K A F
Y F E O N T I K E C F O O
F D A R O I R A I E A L Z
R R N U E T T L C Z E R O
O A O I T T S F Y E S C F
Z Z R S W U T W I E L O T
E Z R E T E M O M R E H T
N I E N L B N N P F D C I
I L T I S C I S C S W S L
O B N S N M I T U R S I R
G N I W O L B C E G U A G
G L W E W R L L I H C V L
O N I A O L F G G H I L W

SNOW
AUTUMN
WINTER
FROST
FREEZE
THERMOMETER
SPOTTER
SLICK
GLOVES
SCARF
FROSTBITE
GAUGE
BLIZZARD
DRIFTING
BLOWING
SNOWFLAKE
BOOTS
SLED
ICY
ICICLE
FROZEN
ZERO
CHILL
WINDY

Answers on Page 14

Steam from the sugar beet factory hovers over Billings in below zero temperatures.
Photo by Carolyn Willis

Snow-laden trees
Photo by Carolyn Willis

December 8, 1972 – The Billings low temperature was 25 degrees below zero, and the high was 14 below. This was the 3rd straight day that the high temperature did not exceed 11 below zero in Billings.

Fall Normals

Submitted by Sean Campbell
Meteorologist

Meteorological fall arrived at midnight on Thursday, September 1, 2011, and ends at 11:59 pm on Wednesday, November 30, 2011. Here are the average temperatures and precipitation for Billings, Miles City and Sheridan for the fall season. These are 30 year averages calculated from 1981 to 2010. All temperatures are in degrees Fahrenheit and all precipitation amounts are in inches.

Billings					
Date	**High**	**Low**	**Average**	**Precipitation**	**Snowfall**
9/1 – 9/30	73.1	47.5	60.3	1.30	1.1
10/1 – 10/31	59.4	37.1	48.2	1.18	4.1
11/1 – 11/30	45.3	26.3	35.8	0.63	6.5
9/1 – 11/30	59.3	36.9	48.1	3.11	11.7

Miles City				
Date	**High**	**Low**	**Average**	**Precipitation**
9/1 – 9/30	74.2	46.1	60.1	1.08
10/1 – 10/31	59.2	33.8	46.5	0.92
11/1 – 11/30	43.2	20.9	32.0	0.39
9/1 – 11/30	58.9	33.6	46.3	2.39

Sheridan				
Date	**High**	**Low**	**Average**	**Precipitation**
9/1 – 9/30	74.2	41.6	57.9	1.43
10/1 – 10/31	60.1	30.9	45.5	1.41
11/1 – 11/30	45.9	19.4	32.7	0.71
9/1 – 11/30	60.1	30.6	45.4	3.55

Photo by Carolyn Willis
Bird on a wire near Pompey's Pillar, Montana

Frost and Freeze Information

Submitted by Sean Campbell
Meteorologist

Many people have started harvesting crops and gardens across the region. Important dates to keep in mind are the first frost, freeze and hard freeze dates in the fall. The following are the average first frost, freeze and hard freeze dates for Billings, Miles City and Sheridan. The frost temperature is based on 36 degrees Fahrenheit, the freezing temperature is based on 32 degrees Fahrenheit and the hard freeze temperature is based on 28 degrees Fahrenheit. The average dates are based on a 30 year average from 1981 to 2010. The first frost, freeze and hard freeze dates are based on a period of record. Record keeping began for the Billings Airport in 1934, the Miles City Airport in 1937 and at the Sheridan Airport in 1907.

City	Average First Frost	Earliest Frost on Record	Average First Freeze	Earliest Freeze on Record	Average Hard Freeze	Earliest Hard Freeze
Billings	Sep 24	Aug 24	Oct 4	Sep 4	Oct 11	Sep 11
Miles City	Sep 21	Aug 22	Sep 29	Sep 2	Oct 7	Sep 11
Sheridan	Sep 11	Jul 2	Sep 20	Aug 17	Oct 3	Aug 25

Winter Normals

Submitted by Sean Campbell
Meteorologist

Meteorological winter arrives at midnight on Thursday, December 1, 2011, and ends at 11:59 pm on Wednesday, February 29, 2012. Here are the average temperatures and precipitation for Billings, Miles City and Sheridan for the winter season. These are 30 year averages calculated from 1981 to 2010. All temperatures are in degrees Fahrenheit and all precipitation amounts are in inches.

Billings					
Date	**High**	**Low**	**Average**	**Precipitation**	**Snowfall**
12/1 – 12/31	35.2	17.8	26.5	0.50	8.2
1/1 – 1/31	36.4	17.8	27.1	0.48	8.4
2/1 – 2/29	40.2	20.6	30.4	0.48	6.2
12/1 – 2/29	37.2	18.7	28.0	1.46	22.8

Miles City				
Date	**High**	**Low**	**Average**	**Precipitation**
12/1 – 12/31	30.9	9.7	20.3	0.29
1/1 – 1/31	30.0	8.9	19.5	0.32
2/1 – 2/29	35.5	13.2	24.4	0.23
12/1 – 2/29	32.1	10.5	21.3	0.84

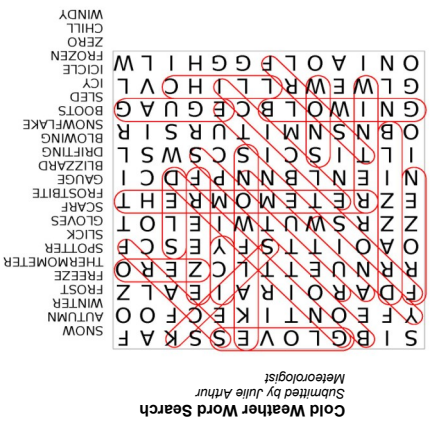
Sheridan				
Date	**High**	**Low**	**Average**	**Precipitation**
12/1 – 12/31	35.2	10.6	22.9	0.56
1/1 – 1/31	36.2	11.4	23.8	0.56
2/1 – 2/29	39.0	14.2	26.6	0.54
12/1 – 2/29	36.8	12.0	24.4	1.66

"Rural Route" - Near Nye, MT
Photo by Carolyn Willis

October 9-13, 2008 – Heavy wet snow fell across the area resulting in numerous downed trees and power lines; 13"-22" of snow fell in the Billings area; 3-4 feet at Red Lodge and along the Beartooth foothills.

Wood duck, north of Forsyth, Montana
Photo by Carolyn Willis

Answers to Cold Weather Word Search on page 12



Cold Weather Word Search
Submitted by Julie Arthur
Meteorologist

1981-2010 30 Year Climate Normals

Submitted by Joe Lester
Meteorologist

The new 1981-2010 climate normals were made available to the public on August 1, 2011. Climate normals, calculated by the National Climatic Data Center in Asheville, NC, are updated every 10 years and based on the most recent 30 years of data for a large number of sites across the country. Thus, the most recent climate normals are based on the 1981-2010 period. Climatological variables for which normals are calculated, include temperature, precipitation, snowfall, and heating and cooling degree days. The new normals are reflected in the daily, monthly, seasonal and annual climate summaries issued by the National Weather Service. In our region, the most recent decade was warmer and drier than the 1970s, so temperature normals went up and precipitation normals went down in comparison to the old 1971-2000 values. The following tables illustrate the changes in average annual temperatures and precipitation at Billings, Miles City and Sheridan.

	81-10 avg Temp (F)	71-00 avg Temp (F)	Change (F)	81-10 avg Pcpn (Inches)	71-00 avg Pcpn (Inches)	Change (Inches)
Billings	48.2	47.4	+0.8	13.63	14.76	-1.14
Miles City	46.9	46.4	+0.5	12.34	13.43	-1.09
Sheridan	45.7	45.2	+0.5	14.08	14.70	-0.62

Summer 2011 in Review

Submitted by Joe Lester
Meteorologist

Meteorological summer is defined to be the months of June, July and August. After a cool and very wet May, the summer of 2011 turned out to be slightly warmer and drier than normal. June was relatively cool, whereas July and August were on the warm side. Much of the area received below normal precipitation during July and August as well. Despite the warm latter part of the summer, the heat was not extreme. Billings and Sheridan experienced only one hundred degree day each, and Miles City peaked at 99 degrees. The following tables summarize the summer's temperature and precipitation totals.

	Summer 2011 avg Temp (F)	Departure from Normal (F)	Summer 2011 avg Pcpn (inches)	Departure from Normal (inches)
Billings	70.3	+ 0.6	4.10	- 0.09
Miles City	70.7	0.0	4.85	- 0.21
Sheridan	68.1	+ 1.2	2.88	- 1.14

Sheridan, Wyoming Period of Record Extended

Submitted by Joe Lester
Meteorologist

Observations at the current location of the Sheridan Airport began in 1940. Maximum and minimum temperatures, as well as precipitation, have been recorded daily since 1940. Until now, that data has been used as the period of record for the city of Sheridan, Wyoming. Between 1907 and 1940, a separate Weather Bureau site, located within a mile of the current airport, took daily observations of temperatures and precipitation. After careful quality control, the National Weather Service has added this data to the period of record for Sheridan. As a result, record temperatures and precipitation as stated in various NWS climate products, reflect conditions at Sheridan from 1907 through the current year. We believe that this extension in data more accurately represents the period of record at Sheridan, and will help us to better understand and study the climate of north central Wyoming. As a result of this adjustment, the following now stand as records for Sheridan, Wyoming:

Record low temperature: -41 F (December 9, 1919)
Record warmest low temperature: 76 F (July 28, 1935)
Warmest Year: 1934 (average temperature 48.7 F)
Coldest Year: 1916 (average temperature 40.7 F)
Hottest Month: July 1936 (average temperature 77.9 F)
Coldest Month: January 1916 (average temperature 1.7 F)
Wettest Year: 1923 (total precipitation 29.79 inches)

Jet Stream Jargon
National Weather Service
2170 Overland Avenue
Billings, MT 59102

RETURN SERVICE
REQUESTED

NWS Windchill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01